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Light and Lighting

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Principal Contents:

	PAGE
Editorial Notes	1
Notes and News	2
"Subjective Brightness"	4
The Lighting of Cinema Auditoriums	5
Lighting Literature	6
Recent Patents	8
Illuminating Engineering Abroad	14
Public Lighting in Dublin	16
Where to Buy	20

A Thing is As Bright As It Looks!

EDUCATION in Appraisal of Lighting Effect has proceeded by Stages.

First we thought only of the Candlepower of the lamps, *then* of the Illumination they furnished on the object examined, *last* of the brightness of the object itself—getting nearer all the time to the final result of all our lighting, the impression formed by the human eye.

Brightness is an important quality, often more vital than illumination—on road surfaces for instance. But we have hitherto assessed it photometrically, in terms of "candles per square inch," "equivalent foot-candles" and the like, which take account of the reflecting power of the surface, but still depend only on external factors, not on what the eye actually sees.

Now Dr. W. D. Wright in his paper on "Subjective Brightness" (see p. 4) attempts to go to the root of the matter. He offers two alternative methods, one based on memory, the other on binocular effect (a field in which Mr. A. W. Beuttell did pioneering work many years ago)—both difficult to apply, but helpful in giving an indication how *apparent brightness* may be dimmed by the presence of glare, or even an adjacent area of brightness that is not strictly glaring. Evidently here interpretation is as important as precision of measurement.

How far even is seeing believing?

Right here one hears the contention that even the eye is not the final arbiter in illuminating engineering. What of the mental judgment and analysis of the ocular impression? Enough for the present.

The President Returns

Readers of this journal and members of the Illuminating Engineering Society in particular, will be interested to hear of the return of their President, Mr. Percy Good, who has been absent for some months on a special mission to Australia and New Zealand. During his visit Mr. Good had opportunities of making contact with the Illuminating Engineering Societies in Melbourne and Sydney, as well as meeting friends in New Zealand. He was invited to give an address at a luncheon arranged jointly by the Illuminating Engineering Society of Australia and the Electrical and Radio Manufacturers Association held in Sydney in September last, in the course of which he touched on problems connected with standardisation, radio, and electrical interests and illumination—referring to the work of the B.S.I., the I.E.S., and the N.I.C. in this country. He also urged that Australasia should be associated with the I.I.C. and should be fitly represented at the conference to take place in Holland in June next. Both at Sydney and at Melbourne Mr. Good was warmly greeted. Whilst members of the Society in this country naturally felt that they were making some sacrifice in relinquishing their President for the opening part of the session—in spite of the willing and efficient way in which his predecessor, Dr. English, has carried on during his absence—they took legitimate pride in the fact of their President being thus called into consultation. They were also glad that the visit provided an opportunity for him to express personally the warm interest that all of us feel in the efforts of our friends in Australia and New Zealand.

Visibility in Street Lighting

The group of papers by Mr. J. M. Waldram, Mr. C. Dunbar, and Mr. F. C. Smith on the above subject, which formed such an impressive trio at the general meeting in London on November 8, were presented again at meetings in Manchester, on November 16, and Leeds on December 12. We hear that the latter meeting was particularly successful in attracting a good audience in spite of the somewhat technical nature of the subject, a good feature being the presence of representatives of street lighting committees in Leeds and other cities. Mr. Councillor Sellers, chairman of the centre, presided, and amongst those who joined in the discussion were Mr. Alderman Bretherick (chairman of the City Gas Dept.) and Mr. Councillor Womersley (a member of the Street Lighting Committee).

Lighting in Cotton Mills

The various I.E.S. Local Centres are all in course of development and their programmes increase in value every year. One evident opportunity they afford is for the discussion of subjects of local importance, such as the lighting of steel works, foundries, textile mills, etc., which cannot be studied nearly so fully (if at all) in London. A good instance is afforded by the paper by Mr. G. A. Rae, delivered at a meeting arranged by the I.E.S. North Western Area Local Centre at Rochdale, on December 14. We hope, in a coming issue, to give some account of this paper in which numerous lighting problems of special interest to the cotton industry were discussed. We learn with interest that Mr. James Sellars, the local hon. secretary, has now been asked to arrange for a similar paper by the Bolton and District Cardiers and Overlookers Association.

I.E.S. Meetings

N.B. *Unless otherwise announced all meetings commence at 7 p.m.*

LONDON.

Jan. 17th. Fourth Report of the Departmental Committee on Lighting in Factories (H. C. Weston, A. E. Iliffe, G. Chelioti and R. W. Daniel); *Institution of Mech. Engrs., Storey's Gate, Westminster, S.W.1.*

Jan. 24th. The Relation Between the Illuminating Engineer and the Fittings Designer (H. Bright); *E.L.M.A. Lighting Service Bureau, 2, Savoy Hill, W.C.2.*

Jan. 27th. The Design of Street Lanterns (J. Bertram and R. Maxted); *Royal Society of Arts, 18, John Street, Adelphi, London, W.C.2.*

Jan. 31st. Visit to **Dufay-Chromex Laboratories,** *Elstree.*

Feb. 13th. Visit to Research Laboratories of the British Thomson Houston Co., Ltd. *Rugby.* **Research on the Production and Utilization of Light** (H. Warren). (Whole day visit.)

Feb. 14th. Maintenance of a Lighting Installation (J. Fletcher, of Montague Burton Ltd.); *Charing Cross Hotel, Strand, W.C.2.*

Feb. 28th. Lighting of the Modern Cinema (T. P. Bennett); *E.L.M.A. Lighting Service Bureau, 2, Savoy Hill, W.C.2.*

MANCHESTER.

Jan. 18th. The Lighting Requirements of a Large Store (O. Waygood); *Engineers' Club, Albert Square.* **(7.15 p.m.)**

LEEDS.

Jan. 9th. Decorative Materials and Their Response to Light (R. O. Ackerley); *The Electricity Showrooms, The Headrow.*

GLASGOW.

Jan. 18th. Photometers and Photometry (H. E. de Weerdt); *19, Gordon Street.* **(7.30 p.m.)**

Feb. 15th. Factory Lighting and the New Factory Act; *"The Gordons," 19, Gordon Street.* **(7.30 p.m.)**

DUBLIN.

Jan. 17th. Electric Filament Lamps (E. D. McAlister); *Engineers' Hall, 35, Dawson Street.* **(6.30 p.m.)**

Feb. 21. Luminescent Tube Lighting (C. W. Galton); *Engineers' Hall, 35, Dawson Street.* **(6.30 p.m.)**

Lighting by Gas

It was a happy idea to incorporate in the programme of the I.E.S. Glasgow Local Centre a paper dealing with gas lighting.

At the third meeting of the session on December 21 a paper on this subject was read by Mr. A. R. McGibbon. Mr. J. H. Scott, who presided, referred to the loss which the Centre had sustained in the recent death of Mr. S. Kates, a member of the committee, who had been very helpful and had done very able work in illuminating engineering.

Mr. McGibbon then addressed the meeting and conveyed greetings from the parent body. In the course of his address, the speaker dealt with the evolution of gas burners and the production of gas mantles. The next step in development was in the burners themselves, the speaker indicating how, in the latest type of gas lantern, adjustments could be made to suit various colorific values of gas.

Mr. McGibbon dwelt on the final report of the Ministry of Transport, and indicated how gas lighting could fulfil all these requirements. These he illustrated by means of lantern slides. The fourth report of the departmental committee on factory lighting was also discussed and a fitting demonstrated which met the requirements contained in the report in regard to cut-off and brightness.

The lecturer also demonstrated the latest form of gas gun and also the latest means of controlling gas installations by means of photo-electric cells which automatically control street lighting, switching on when dark and off when light. The latest Comet control, enabling remote control of street lighting installations, was demonstrated, together with a special device incorporated in street lighting bollards, which automatically cut off the gas supply if the bollard itself became broken.

The lecturer having replied to various questions raised in the discussion, the meeting terminated with a vote of thanks by Mr. P. E. Smith.

I.E.S. ANNUAL DINNER

The attention of members is drawn to the **Annual Dinner,** to take place on **Tuesday, March 14** (6.45 for 7.30 p.m.). Tables are already being allotted and early application for tickets (price 15s., exclusive of wine) is advisable.

"Mixed" Lighting

A special aspect of the use of discharge lamps—their combination with filament lamps to give an approach to white light—was discussed at a meeting of the I.E.S. Commercial Lighting Section, on November 16. Mr. W. R. Stevens illustrated his introductory address by a series of effective experiments which illustrated the various precautions to be observed in making combinations of mercury and filament lamps. In connection with demonstrations of mixed light from sodium discharge lamps and filament lamps, it was pointed out that one cannot thus get a good "colour blend"—though in the course of the discussion the opinion was expressed that in certain show-windows (for example, one devoted to radio equipment) sodium lamps had proved more effective than any other form of illumination.

In the subsequent discussion most speakers seemed to agree that "mixed" lighting can be used with advantage in commercial lighting. It was, however, interesting to hear the experience of Mr. J. Mellanby, of John Lewis and Co., who instanced certain departments (such as those devoted to furnishing, carpets, china and glass, and ironmongery) in which blended light had proved suitable, and others (e.g., fabric departments) in which there was difficulty. Mr. Mellanby also emphasised the undesirability of a patchy effect on the surface of the lighting fitting; with a view to avoiding this defect, he preferred a combination of a number of filament lamps with one central mercury lamp

Mr. Percy Good in America

Mr. Percy Good, President of the Illuminating Engineering Society (London), on his way home after his visit to Australia, meets Mr. D. W. Atwater, President of the Illuminating Engineering Society (U.S.A.), at the Electrical Testing Laboratories in New York.

Electric Discharge Lamps and their Application to Industrial Lighting

At a meeting of the I.E.S. Industrial Lighting Section held in the lecture theatre at the Home Office Industrial Museum, on November 16, there was a keen discussion on the above subject. In the unavoidable absence of the author of the introductory address (Mr. C. A. Hughes), Mr. C. R. Bicknell stepped into the breach. He reviewed the chief characteristics of discharge lamps, and pointed out that for most forms of industrial work the colour of the light constituted no drawback; indeed, for certain purposes, it was an advantage. Lantern slides of numerous installations utilising such lamps were thrown upon the screen.

Some discussion took place on the economic factors involved in the choice between discharge lamps and filament lamps, which was influenced in some degree by the cost of electric energy. It was contended, however, that only in very exceptional circumstances would filament lamps prove the least expensive. The reasons why light from discharge lamps apparently gave rise to sharper outlines of objects or involved less visual effort were also discussed; some speakers attributing this effect to the want of achromatism of the eye-lens. Questions were also asked in regard to the conditions under which inconvenient stroboscopic effects might arise, and various precautions (such as mounting lamps on alternate phases, combining with filament lamps, etc.) were suggested. It was, however, considered that such effects are unlikely to be experienced with lamps run on normal frequencies.

The Response of the Eye to Light

Measuring Subjective Brightness

In what follows we give a summary of the paper on this interesting subject, read by Dr. W. D. Wright at the meeting of the Illuminating Engineering Society on December 13, 1938.

The last few years have seen considerable advances in our knowledge of the physiology of vision, but many of the more important papers, since they describe work done by research physiologists, have naturally been published in journals other than those usually read by the illuminating engineer. It was therefore particularly valuable to members of the Illuminating Engineering Society to have, at their meeting on December 13, a paper on the difficult subject of subjective brightness read by Dr. W. D. Wright, of the Imperial College of Science. It will be remembered that about a year ago Dr. Wright gave a most interesting course of lectures in which he described the various phenomena of light perception as they affected the work of the illuminating engineer.* He was, therefore, peculiarly qualified to explain to members of the Society the many difficulties involved in any attempt to evaluate something which is, in essence, subjective and therefore inaccessible by the ordinary methods of physical measurement.

Reaction of the Eye to Light.

In the first part of his paper, Dr. Wright gave an admirable summary of the available information regarding the reaction of the eye when stimulated by light. The objective data include measurements of the electrical impulses which travel down the optic nerve whenever the retina is illuminated, studies of the photochemical reactions which take place in that peculiar liquid found in our eyes, the visual purple, and, finally, measurements of the expansion or contraction of the iris which take place quite involuntarily when the condition of the eye as regards exposure to light is suddenly changed.

Under the heading "subjective data," Dr. Wright gave a summary of the results obtained by various investigators who have studied such phenomena as the minimum (threshold) brightness perceptible to the eye after it has been subjected to any one of a large variety of conditions of pre-exposure to a bright field of view, glare from a source of high candle-power and the like.

Adaptation Processes.

In his general discussion of both the objective and the subjective data, Dr. Wright said that the sensitivity of any portion of the retina at a given instant was governed by three sets of conditions, viz., (i.) a comparatively slow adaptation to the total amount of light entering the eye from the whole field of view (an adaptation probably due to the photochemical reactions in the visual purple), (ii.) a rapid adaptation to the total amount of light entering the eye (this adaptation was probably electrical in its nature), (iii.) a rapid adaptation (also electrical) which was "local," i.e., controlled by the brightness of the object looked at directly and its immediate surroundings. The first two processes, he said, remained more or less constant as the eye darted about over the scene, while the third process followed quite rapidly the changes of brightness from point to point. The impression which the eye conveyed to the brain was a combination of the steady and the rapidly varying effects. As a practical illustration Dr. Wright referred to the case of two advertisements, mounted side by side in an underground train, one with black lettering on a white ground, the other with white lettering on a black ground. While measurements with a photometer showed that all the white surfaces were equally bright, to the eye the white lettering appeared brighter than the white background. The explanation given by Dr. Wright was that, as the passenger looked around, the two adaptation processes depending on "total" light varied but little, since the advertisements were close together. Since, however, the amount of light from the black advertisement was much less than that from the white one the "local" adaptation was very different in the two cases, and the sensitivity was much greater when the black advertisement was being looked at. Consequently the same physical stimulus, the brightness of the white, produced a greater effect in this case than it did when the white advertisement was viewed.

Measuring Subjective Brightness

In the second section of his paper Dr. Wright dealt with the very difficult problem of "measuring" subjective brightness. This, as he pointed out, is quite impossible, strictly speaking, as it implies the measurement of a sensation. However, it should not be entirely out of the question to set up a reference scale of subjective brightness so that any given physical brightness seen under given conditions may be placed in its proper place on the scale even though the relative values of the steps in the scale can only be gauged quite roughly. Dr. Wright pointed out the many difficulties in the way of giving practical effect to such a scheme, but at the same time he threw out some interesting hints as to the lines along which a solution of the problem might hopefully be sought. He then touched upon the measurement of subjective colour and described the binocular matching colorimeter which he had recently constructed for work in this field.

The measurement of subjectve contrast is, of course, dependent upon the possession of a means for measuring subjective brightness and Dr. Wright briefly discussed this extension of the problem in the final section of his paper. He appropriately concluded with some words of encouragement to those who might be inclined to form the opinion that the difficulties in the way of measuring subjective brightness were so numerous as to make the task almost hopeless. "It is," he said, "not uncommon, after a subject has been examined as a complex academic problem, for the engineer to overcome the objections and provide an entirely satisfactory answer in some simple way." We may join with Dr. Wright in hoping that this will happen in the present instance.

Among the visitors present when Dr. Wright's paper was read there were a number of members of the Vision Committee of the Medical Research Council and several of these joined in the very interesting discussion which followed. The discussion was, in fact, opened by Dr. R. J. Lythgoe, who is a member of the Vision Committee.

* These lectures are now available in book form under the title "The Perception of Light."

The Lighting of Cinema Auditoriums

Summary of a paper read by Mr. H. C. Weston and Mr. E. Stroud at the meeting of the Illuminating Engineering Society on January 10, 1939

The paper on this subject, read by Mr. H. C. Weston and Mr. E. Stroud, dealt mainly with the investigations of a committee appointed at the request of the London County Council, whose report was attached to the paper as an appendix. The task of the committee was to consider the practicability of adjusting the standard of maintained lighting in cinemas so as to give sufficient visibility to enable persons on entering from daylight to make their way unaided to their seats.

The committee, in coming to conclusions on this point, had to consider the desirable illumination to achieve this object, the present practice in the lighting of auditoriums, the effects of such illumination on the visibility of the pictures presented, and the illumination required for safe exit in emergency.

There are two distinct values of illumination to be considered, that ordinarily available whilst films are being shown, and that provided by the secondary or safety lighting which the regulations demand. The latter illumination is in general very low indeed—in fact it is doubtful whether it amounts to even 0.001 ft.c. in many cinemas.

Visits were made to a number of typical cinema theatres. Data presented for these various cases showed minimum values ranging from 0.001 to 0.03 ft.c. with maxima from 0.06 to 0.14. Screen illuminations in these theatres were as follows:—

without film or shutter	6 to 22 ft.c.
without film but with shutter	3 to 11 ft.c.
with film and shutter	1 to 2 ft.c.

No doubt the illumination on the screen has a direct bearing on the permissible illumination in the theatre. In the early days of cinema theatres, when neither screens nor projectors of high efficiency were available, it was natural to make the auditorium illumination as low as possible. But conditions are otherwise now. Interesting light is thrown on this problem by the work of the Japanese N.I.C. reported in 1931, showing an average screen illumination of 68.2 lux* and an average auditorium illumination of 1.1 lux—a ratio of 62:1. This committee suggested a minimum auditorium illumination of 1.5 lux. With 100 lux on the screen stray light from such auditorium lighting had no serious effect.

Similar conclusions seem to have been formed in the United States of America, where an illumination of as much as 0.1 ft.c., rising to 0.2 ft.c. at the back of the auditorium, has been proposed.

The committee on which the authors served attacked the problem in two ways: (a) by observing for themselves the effect of various illuminations on visibility, and (b) by experiments designed to test the effect of stray light on the picture. (It should be noted that after two minutes adaptation to the conditions in the darkened auditorium visibility improves very greatly. It is important, therefore, to note the visibility at the moment of entry.) Independent observations by eight observers led to the conclusion that visibility on entry, decidedly poor with 0.01 ft.c., became quite good with 0.08 ft.c., and that illuminations up to this value had no appreciable effect on the quality of the picture.

It is indeed believed that the acuity and contrast sensitivity of the eye are both improved by suitably illuminating the surrounds of the central field of vision. The I.E.S. Committee witnessed a demonstration in which the picture was even surrounded by a brightly illuminated border in colour. This practice was claimed to accentuate the blacks in the picture and improve the apparent contrast. Other experiments, since made in one of the largest London theatres, support the belief that a neutral illuminated surround improves the appearance of coloured films.

There are, of course, numerous points in connection with the lighting of auditoriums, such as the vital importance of keeping sources of light out of the view of the audience and the advantages of adopting diffused lighting from large illuminated areas, giving a uniform distribution of light over the seats. Much also depends on the choice of colours for seats and stair-carpets, etc. Light colours which show up well by a low illumination are to be preferred.

The actual recommendations of the I.E.S. Committee, set out in their report to the L.C.C., are:—

> **(1) If it be desired to maintain sufficient lighting to enable persons entering the cinema from daylight to see their way easily and safely to their seats without the use of handtorches, then the total maintained illumination (primary plus secondary) should, in general, be not less than 0.05 ft.c. throughout the auditorium, and, where entrance is made from the rear of the stalls or circle, should preferably be graded from 0.08 ft.c. at the rear of the auditorium to not less than 0.05 ft.c. at the front.**
>
> **(2) The secondary (or safety) illumination should, in general, be not less than 0.0025 ft.c. throughout the auditorium.**

In view of the experiences of the committee, and the values suggested in the United States and Japan, these figures must be considered very moderate.

By the courtesy of the Gaumont-British Picture Corporation, Ltd., in whose private theatre the meeting was held, indirect illumination of the value specified above was provided whilst films were being shown, so that the audience could judge for themselves the degree of visibility attained and the effect, if any, on the appearance of the film.

In the subsequent discussion several speakers expressed their belief that values considerably higher than the minima proposed by the committee could be adopted without detriment to the film—especially bearing in mind that by proper design of the lighting the illumination of the screen due to stray light might be only a fraction of that provided over the seats in the auditorium. It was also pointed out that the fear that the audience might be unable to concentrate attention unless left in darkness found no justification from experience with other forms of entertainment—for example, football matches, invariably staged in full daylight. Mr. H. Buckley, however, did draw attention to one difficulty, that of measuring such low values of illumination with a photometer, especially in view of the coloured light often used, in which connection a rough demonstration of the Purkinje effect was given.

* One "lux" is roughly equivalent to 1-10th ft.c.

Literature on Lighting*

(Abstracts of Recent Articles on Illumination and Photometry in the Technical Press)

I.—RADIATION AND GENERAL PHYSICS.

1. Vision in Nature and Vision Aided by Science.

Lord Rayleigh. Nature, Vol. CIVII., No. 3,590, p. 327, August 20, 1938.

Summarises the fundamentals of vision and of optical design, and predicts notable advances in electron optics. (A complete report of the presidential address to the British Association, delivered at Cambridge, August, 1938.) R. G. H.

II.—PHOTOMETRY.

2. Photrix Universal Photometer.

Anon. Am. Illum. Eng. Soc. Trans., 9, p. 763, November, 1938.

Two photo-electric portable photometers are described. Model A has ranges of 0-2.5, 0-10, 0-50, and 0-250 foot-candles, and Model B 0-12 and ranges up to 1,000 foot-candles. Accuracy and shock-proof construction are features of the design. J. S. S.

3. Phototubes Save Coating Metals.

Alexander Ball. Electronics, 11, No. 11, p. 48, November, 1938.

The author describes apparatus devised for examining the surface structure of metal surfaces and plated coatings, by means of their reflection properties. The primary object was in relation to the corrosion-resisting properties of the metals, but data on their response to incident light becomes available by the use of the equipment. A photoelectric device is used to measure the lustre of the surface by the spread of a narrow pencil of light falling on the surface. S. S. B.

III.—SOURCES OF LIGHT.

4. Early Days of Lamps and Valves.

Anon. El. Times, 94, pp. 695-696, November 24, 1938.

An illustrated account of the early stages of incandescent filament lamps, referring particularly to Swan's lamps. W. R. S.

5. Watercooled "Midget Sun" Announced by Manufacturers.

Anon. Am. Illum. Eng. Soc. Trans. 9, p. 759, November, 1938.

A 1000-watt water-cooled mercury vapour lamp is described. Special control gear is used to prevent the arc being struck when the water is not circulating. The light output is given as 65,000 lumens, and the life as fifty hours. J. S. S.

6. Characteristics of Fluorescent Lamps.

A. B. Oday. Magazine of Light VII., No. 7, pp. 18, 19, 30, Fall, 1938.

A summary is given of the characteristics of a range of short, tubular, fluorescent lamps developed in America. C. A. M.

7. Utilisation of Fluorescent Lamps.

L. G. Gianni, W. M. Potter, J. M. Smith, A. K. Gaetjens, F. B. Lee. Magazine of Light VII., No. 7, pp. 8-15, 20-23, Fall, 1938.

Numerous instances are given of the use to which fluorescent tubular lamps can be placed. Shop lighting, office lighting, and industrial lighting are considered. C. A. M.

8. Black Light.

"Pharos." Elect., 121, p. 621, November 25, 1938.

A discussion is given of the uses to which ultra-violet radiation from mercury vapour lamps now on the market can be placed. C. A. M.

IV.—LIGHTING EQUIPMENT.

9. New Lamps Combine Bulb and Reflector.

Anon. Am. Illum. Eng. Soc. Trans., 9, p. 763, November, 1938.

A new type of Mazda lamp is announced, in which metal is coated on the inside of the bulb to form a complete projection unit. Types giving narrow or widespread beams are available, and are intended primarily for use in shop windows. J. S. S.

10. A Static Constant-Current Circuit.

C. M. Summers. Elect. Engineering, 57, p. 636, November, 1938.

The author describes the design of a circuit using an iron-cored reactor, of predetermined characteristics, in parallel with a condenser of specified size, such that the resultant input current is independent of the line voltage over wide variations in this voltage or the load impedance, within certain limits. It is considered to be useful for series lighting circuits. S. S. B.

11. Cinema Studio Equipment.

Anon. Elect., 121, p. 604, November 18, 1938; p. 646, November 25, 1938.

Descriptions, with photographs, are given of cinema studio lighting equipment recently on exhibition in London. Examples include those developed for use with incandescent tungsten lamps. C. A. M.

12. Sterilisation by Ultra-violet Radiation.

Samuel G. Hibben and P. W. Blackburn. Elect. Engineering, 57, p. 455, November, 1938.

The authors discuss in considerable detail the use of ultra-violet radiation for purposes of sterilisation, and the application of a special design of lamp to this end. S. S. B.

V.—APPLICATIONS OF LIGHT.

13. Thresholds and Supra-Thresholds of Seeing.

M. Luckeish, F. K. Moss. Am. Illum. Eng. Soc. Trans., 9, pp. 786-813.

Thresholds and Supra-Thresholds of visibility are discussed, the latter being defined as the visibilities necessary to ensure maximum practical output of work or achievement, and, secondly, the greatest ease of seeing. These two criteria are generally different. Visibility measurements are then discussed in connection with the Luckeish-Moss visibility meter. Two scales of visibility are deduced, the first involving the

*We take this opportunity of acknowledging the services of the members of the Illuminating Engineering Society and others who have contributed items to "Lighting Literature" during the past year: S. S. Beggs, F. J. C. Brookes, H. M. Cotterill, Dr. S. English, R. G. Hopkinson, C. A. Morton, H. L. Juliusburger, J. Score-Smyth, W. R. Stevens.

size of just perceptible objects, and the second being based on the relation between size and brightness contrast for threshold visibility. The latter has the advantage that visibilities can be expressed as a percentage of the maximum possible, and is of use in considering supra-threshold visibility. J. S. S.

14. Seeing.

L. E. C. H. Elect., 121, pp. 639-640, November 25; pp. 667-668, December 2; p. 699, December 9; pp. 727-728, December 16, 1938.

A series of articles reviews the normal behaviour of the eye and phenomena associated with colour-vision. C. A. M.

15. Lighting Standards.

Walter B. Lancaster. Magazine of Light, VII., No. 7, pp. 24-27 and 36, Fall, 1938.

A discussion is contributed by an ophthalmologist of the various criteria to be considered in forming standards of lighting. C. A. M.

16. Eye and Brain as Factors in Visual Perception.

R. H. Thouless. Nature, Vol. 142, No. 3,590, p. 346, August 20, 1938.

Discusses the psychological processes which govern the transmission of the retinal image to the brain. There is, for example, a relationship between the apparent shape, size, or brightness of an object, the real shape. size, or brightness, and the retinal image of the object. R. G. H.

17. Light and Architecture.

Anon. Am. Illum. Eng. Soc. Trans., 9, pp. 767-774, November, 1938.

Some representative architectural lighting schemes are described, with photographs. J. S. S.

18. Lighting Requirements in the Average American Home of 1938.

Mariquita Dygert. Am. Illum. Eng. Soc. Trans., 9, pp. 839-858, November, 1938.

The paper compares the lighting of the home now and fifteen years ago, and discusses the design and application of modern equipment. J. S. S.

19. Specification of Lighting in Decorative Residence Interiors.

H. G. McKinlay and Mark Webber. Am. Illum. Eng. Soc. Trans., 9, pp. 815-838, November, 1938.

A number of domestic lighting schemes are discussed, in which the lighting is arranged to harmonise with the style of decoration used. J. S. S.

20. Built-in Lighting in a Library.

Anon. El. Times, 94, p. 606, November 3, 1938.

Gives a photograph and brief account of the lighting in the Edmonton Borough Library, N. London. W. R. S.

21. Poplar Town Hall.

Anon. El. Rev., Vol. CXXIII., No. 3,184, pp. 791-792, December 2, 1938.

Describes, with photographs, the lighting installations at Poplar Town Hall. R. G. H.

22. Church Lighting.

J. B. Harris. El. Rev., Vol. CXXIII., No. 3,182, p. 717, November 18, 1938.

Summarizes the principles involved in the design of church lighting installations. Careful planning is essential if the architectural features of a building are to be preserved. R. G. H.

23. Church Centenary Lighting.

Anon. El. Times, 94, p. 726, December 1, 1938.

Settle Parish Church was floodlit during its centenary week. A photograph is given as well as a photograph of the interior, which has been relighted. W. R. S.

24. Lighting a Modern Cinema.

Anon. El. Times, 94, pp. 587-588, November 3, 1938.

Photographs and a description are given of the lighting of the new Apollo Cinema at Manchester. W. R. S.

25. Lighting in Factories.

W. Robinson. El. Rev., Vol. CXXIII., No. 3,184, pp. 789-790, December 2, 1938.

Reviews the recommendations of the Departmental Committee on lighting in factories in their Fourth Report. A feature of the report is the stress put upon the importance of the correct design of an installation, as well as the importance of adequate illumination on the working plane. R. G. H.

26. Indirect Lighting.

Anon. Magazine of Light, VII., No. 7, p. 28. Fall, 1938.

A brief description with photographs is given of a drawing office in America, lighted by indirect combination units. Each fitting employs one 400-watt mercury lamp and four 200-watt incandescent lamps. An average value of 75 ft.c. is obtained. C. A. M.

27. Industrial Lighting.

Anon. Elect., 121, p. 649. November 25, 1938.

The economics of the simple replacement in an industrial installation of 200-watt general service lamps by 125-watt mercury vapour lamps are given. C. A. M.

28. Industrial Efficiency.

"Works Engineer." Elect. 121, p. 692. December 9, 1938.

Recommendations of illumination requirements are made for garages and motor repair shops. For showrooms indirect lighting is very useful. C. A. M.

29. Illumination of Large Floors.

Anon. El. Times, 94, p. 734, December 1, 1938.

Photographs and descriptions are given of an engineering shop, body building and repair shop, paint shop, and a timber mill. All are lit with tungsten filament lamps. W. R. S.

30. Unidirectional Road Lighting.

Anon. El. Rev., Vol. CXXIII., No. 3,185, p. 835. December 9, 1938.

A short section of the Great Chertsey road has been equipped with unidirectional lanterns designed for the lighting of double carriageways. All the light is directed towards the oncoming traffic. Objects on the road therefore receive no light on the side visible to the observer. A high contrast between objects on the road and the bright background of the road surface is thus obtained. R. G. H.

31. Combination Units Light Arterial Underpass.

W. B. Boast. El. World, 110, p. 1298, November 5, 1938.

Details are given of the lighting equipment used on a number of underpasses on an arterial road in America. The units combined a 400-watt mercury vapour lamp with two 100-watt tungsten filament lamps. Some of the lamps are extinguished at half night and some are all night burning. The circuit arrangements are described, and detailed calculations on the cost of varying mercury-tungsten filament ratios are given. S. S. B.

32. Modern Science Turns Night Into Day at Laidley Stadium.

Anon. Am. Illum. Eng. Soc. Trans., 9, p. 761, November, 1938.

An installation of 160 1,500-watt floodlights at a football field is described. An average illumination of 55 ft.c. is claimed. J. S. S.

33. Sky Darkening Associated With a Severe Thunderstorm.

D. R. Barber. Nature, Vol. 142, No. 3,590, p. 359, August 20, 1938.

Measurements of sky brightness have shown that the obscuring of the sky by heavy stormclouds will reduce the brightness by 1,000—1. R. G. H.

Recent Patents

(Abstracts of recent Patents on Illumination & Photometry.)

No. 493,526. "Improvements in Electric Circuit Arrangements for Operating Electric Discharge Devices."

The General Electric Company, Limited, Bowtell, J. N., and Jenkins, H. G. Dated April 8, 1937. (Divided from Appn. No. 10026/37.)

The object of the invention, described in this specification, is the elimination of earth sheathed high tension leads for feeding high voltage discharge lamps. According to the specification, a pair of double wound step-up transformers spaced several feet apart and both having their primaries fed from the same alternating supply have their secondaries connected in series by a pair of discharge lamps, each member of the pair connecting an end of the secondary of one transformer to an end of the secondary of the other transformer. The transformers are respectively disposed close to the opposite ends of the discharge lamps so that the connecting leads are quite short.

No. 494,001. "Improvements in and Relating to Light Projecting Devices."

The British Thomson-Houston Company, Limited. Dated March 26, 1937. (Convention, U.S.A.)

This specification describes a projector comprising a plurality of focused or concentrating lamp units severally fixed in supports which are pivotally mounted on a holder. A rotatable control member has a crank for each lamp unit and the cranks are connected to the supports by connecting rods so that rotation of the control member rocks the supports about their pivots to cause the individual beams projected by the lamp units to converge at any given distance from the device.

No. 494,068. "Improved Device Comprising a Liquid Cooled High Pressure Vapour Discharge Tube."

N. V. Philips Gloeilampenfabrieken. Dated February 13, 1937. (Convention, Germany.)

This specification describes a light projecting device giving a high intrinsic brilliance and luminous output in a compact form comprising a high pressure vapour discharge tube, a reflector behind the tube, and a casing surrounding both of them and provided with a window for the exit of light. The casing contains a guide member for cooling the liquid. The guide member is formed in such a manner as to allow the supply and discharge conduits for cooling liquid to be at the same end of the device and the current supplying leads for the tube to be at the other end.

No. 494,192. "Improvements in High Pressure Metal Vapour Electric Discharge Lamps."

The General Electric Company, Limited. (Communicated by Patent-Treuhand Gesellschaft Für Elektrische Glühlampen.) Dated July 13, 1937.)

According to this specification a high pressure mercury vapour tube is enclosed within an outer jacket and a reflector disposed within the outer jacket around the tube to concentrate at least one quarter of the radiation from the discharge into a preferred direction. The reflector may be a coating on the interior surface of the outer jacket, or may be a separate metal part.

No. 494,457. "Improvements in Lamps."

Bormann, O., and Julius Pintsch Kommanaitgesellschaft. Dated November 12, 1936. (Convention, Germany.)

This specification describes an anti-dazzle projector, in which an image of the aperture of a condenser system or the light outlet aperture or apertures of a stop or diaphragm in front thereof is formed by an objective of great focal length such that it forms sharp images of horizontal lines and indistinct or blurred images of vertical lines. Thus the objective lens may be astigmatic or it may have shallow vertical grooves or ribs or a grooved or ribbed glass may be placed adjacent a substantially spherical objective lens.

No. 494,507. "Improvements in Electric Circuit Arrangements for Operating Discharge Devices."

The General Electric Company, Limited, Bowtell, J. N., and Jenkins, H. G. Dated February 26, 1937, April 8, 1937, September 6, 1937. (Cognate Applications.)

This specification covers the combination with one or more electric discharge lamps having their terminals at least several feet apart of a pair of transformers of the kind in which one end of the secondary winding is connected to one end of the primary winding by a conductor which is independent of any connection of the windings to any other circuit element, in which each of the pair of transformers is adjacent to one of the terminals and a free end of the secondary of each transformer is connected to the terminal near that transformer; the primaries of the transformers, in series or parallel, are fed from the same supply either directly or through an isolating transformer, and in each of the transformers the ratio of the voltage across the secondary winding to the voltage across the primary winding is considerably greater than unity. The heating current for an electrode may be provided by low voltage winding of a core of the transformer adjacent that electrode.

No. 494,827. "Improvements in Light Sources comprising Electric Discharge Tubes."

N. V. Philips Gloeilampenfabrieken. Dated May 10, 1937. (Convention, Germany.)

This specification describes a discharge tube for producing white light so that objects illuminated thereby may appear their natural colours. A low pressure mercury vapour tube has a wall or a screen consisting of luminescent uranium glass or copper glass and, between the discharge path and the wall or screen, a layer of luminescent powder is arranged to be excited and has a maximum emission at a wavelength between 5,700 and 6,000 A and a half value width of band exceeding 400 A and preferably exceeding 500 A.

BRIGHT LIGHT WITHOUT GLARE

Authorities are agreed that much of the prevalent eye strain and defective sight can be avoided by eliminating the dazzling glare of incandescent gas mantles and other high power lighting units. In practice, Vitreosil (pure fused silica) has proved one of the most efficient available means of diffusing glare without undue loss of light. Vitreosil also possesses unique decorative value and complete heat resistance.

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VITREOSIL

Public Lighting With Gas

Flint Corporation have renewed their contract for street lighting in Flint and Bagillt with the local gas undertaking. A number of twelve-light lamps have been added to those in commission, which now total 329.

Beaminster Parish Council have entered into a five-year agreement for gas lighting in their area.

Colwall Parish Council have renewed their agreement for street lighting by gas.

About 310 lamps are covered by a renewal of the contract for the lighting of Selby's streets by gas. Improvements in the standard of lighting are to be carried out.

Benfleet U.D.C. have entered into a fifteen-year contract for public lighting by gas. Various improvements will give this district an excellent system of lighting on all roads. Out of the 650 lamps installed, or to be installed, no fewer than 261 will have six or more mantles, and none of the lamps on subsidiary roads has fewer than three mantles. All lamps have automatic ignition.

The South Elmsall and South Kirby Parish Councils have entered into seven-year agreements for improved gas lighting in the streets in their areas. About 315 lamps are affected by the new contracts.

Sowerby Gas Department state that the conversion of the street lamps from hand lighting to clock control has resulted in considerable saving of labour and gas; the number of mantles used is lower by about 40 per cent.

Thorne Parish Council have decided that a new estate of 130 houses is to be lighted by fourteen gas lamps. Both gas and electric lamps were inspected, but the gas lamps were considered to give better illumination and to be more economical.

In Dagenham, eighty-three and a half out of eighty-six miles of the thoroughfares are lighted by gas.

Denbigh Town Council has renewed its contract for street lighting by gas.

Uxbridge Urban District Council has entered into a five-year agreement for gas lighting in Uxbridge, Hillingdon, and Cowley. About 674 lamps are affected by the new contract, and various lighting improvements are contemplated.

The gradual replacement of all lamps of a low candle power by modern gas lamps of higher capacity is being carried out by the Prestatyn U.D.C. Gas Department. Of the 329 lamps at present in commission over half now have three or more mantles.

East and Middle Hemmington Parish Council has extended the lighting period of the gas lamps in its area from eight to twelve months in the year.

Solihull Urban District Council has entered into a seven-year agreement for gas lighting over the greater part of its area. About 1,500 lamps are at present in commission, including a number of traffic bollards.

About 345 gas lamps are covered by an eight-year contract for street lighting entered into by the Seaford Urban District Council. The lighting is to be improved by the raising of columns and increases in candle power.

Blaby Parish Council has entered into a seven-year contract for gas lighting in its area. Among the improvements in the lighting contemplated under this agreement is the replacement of all two-light lamps by others of modern type and higher candle power.

Part of the Kendal Rugby Club ground has been floodlighted by gas in order that members might practise at night. The experiment has been a great success.

This Year's Physical Society's Exhibition

At this year's Physical Society's Exhibition there were many interesting exhibits. A feature of the trade section of illuminating engineering was the development of multi-range photometers. A new Ferranti instrument, a multiple and low-range light meter in a handy form, furnishes ranges of 0—1, 0—10, and 0—100 ft.c. The familiar Holophane-Edgcumbe Street Lighting Photometer with a low range of 0—0.3, with an additional range of 0—0.1, was also on view. A simple device is exhibited to determine precisely the angles at which measurements are taken. The Weston Pocket Light Meter, with the addition of a metal diaphragm, allows two ranges, from 0—50 and 0—500 ft.c. respectively.

In a Westinghouse lamp flasher contact without moving parts, exhibited for the first time, flashing is done at a low frequency and is originated by a unit consisting of a choke, a condenser, and a lamp in series across A.C. mains. Its advantage lies in the fact that no moving parts for the origination of flashing are used and, therefore, no wear and tear are involved.

New Types of Photometers.

The Research and Education Section was, as usual, of special interest. Certain instruments previously shown at the opening meeting of the Illuminating Engineering Society last autumn by the General Electric Company, Ltd., were on view. A new multi-range photometer consists of a micro-ammeter calibrated in foot-candles and a cell of the usual size with a basic range of 0—50 ft.c. The cell surface is situated half an inch below an opal test plate which permits the light to be transmitted and gives a better distribution of light all over the cell surface, thus avoiding errors originating by large angles of incidence. Metal diaphragms, with holes of different sizes in the centre, placed on top of this opal plate, allow the ranges to be altered, thus giving this instrument a total range of 0—5,000 ft.c. Two resistances are provided in the instrument which can be varied, the one for calibration and the second for correcting a change of luminaires, for instance, from tungsten to mercury vapour.

Also shown was a brightness meter for the measurement of diffusing light fittings, such as opal glass spheres, etc. This consists of a photometer, the cell of which is arranged on the bottom of a tube-shaped container approximately 6 in. in length. The reading instrument is detached and is connected to the cell housing by flexible leads and calibrated in candles per sq. in. Two ranges are provided, 0—10 and 0—50 c. per sq. in. Yet another instrument designed to measure light-distribution from flood-lights, etc., was demonstrated by means of photographs. With a view to maximum accuracy it is necessary to measure beyond the beam "crossing point." Distances of approximately 200 ft. are, therefore, involved. The apparatus consists of a mirror rotating around the unit under test, which reflects the light to another mirror, and this, in turn, to a third mirror, from which the light falls through a corridor on to a cell. (In cases of ranges over 140 ft. the measuring unit utilises four mirrors.) The apparatus may be arranged for the semi-automatic production of polar curves.

Displays of Fluorescence.

In a special room demonstrations of luminescent compounds took place. Different materials were exposed to a high intensity mercury discharge lamp and their characteristic emission spectra shown; likewise the influence of heat which intensifies the discharge of stored light in the particular area, thus giving brighter local spots. Such substances readily facilitate the testing of glasses for transmission of ultra-violet rays.

The British Thomson-Houston Company, Ltd., also illustrated an ingenious application of stroboscopic effects which enables the various parts of a discharge lamp under construction to be studied and a limit to be set to the vibration at the more delicate points, such as welds.

A Tele-Brightness Meter.

This company also exhibited the Tele-Brightness Meter which, in general appearance, resembles an ordinary theodolite. This is used for surface brightness measurements in connection with street lighting installations, and has a range of 0.001 to 100 equivalent ft.c. This instrument is of special value for the production of standardised photographs in conjunction with the B.T.H. Post Recording Brightness Meter. It consists of a tiny illuminated mirror which is faded into the sectional surface viewed. Colour filters are provided for all light sources, and the brightness of the comparison mirror is varied by means of standard neutral density filters and a calibrated iris diaphragm.

Some of the most interesting exhibits were those of Dr. W. P. Wright, who exhibited his colorimeter in its new form for the first time. Details of this apparatus will appear in the "Journal of Scientific Instruments." The instrument enables tints to be assessed in terms of the three primary colours. It serves primarily as a spectro photometer, but may also be allied for the study of hue discrimination, the colour-sensitives of observers, and observations of saturation discrimination.

A Subjective Photometer.

A subjective photometer was also exhibited by Dr. Wright. This represents the further development of the first model which was used for initial observations. The apparatus serves to measure adaptation and in conjunction herewith aids the determination of factors associated with various diseases of the eye. The instrument consists of a calibrated Fullolite lamp in a lamp house which illuminates two optical systems, separate for each eye. Each system utilises a collimating lens and an observation lens. The light radiated is strictly parallel and focused on the two exit apertures which consist of holes drilled in the end of the observing tubes. Provision to insert filters in the beam is made. An adjustable wedge, photo-metrically calibrated, is arranged in the left eye beam to enable the observer to adjust the intensity of the beam by known amounts. Experiments with this instrument are to appear in this month's issue of "The British Journal of Ophthalmology."

H. L. J.

Public Lighting by Electricity

Pontypridd.—At the end of November the Council is to begin the erection of a new system of street lighting which will include the Cardiff-Merthyr road at Nant Garw. This is a dual carriageway road. The lighting will conform to the recommendations laid down in the M.O.T. Report. 400-watt mercury discharge lamps of the fluorescent type in single piece refractor lanterns, mounted 25 ft. high, on concrete columns, will be utilised. Spacing will be 150 ft. Each carriageway is to be treated as a separate road. It is expected that the new lighting will be completed about the middle of January.

Staveley.—Sodium electric discharge lamps were used for the lighting of sections of main road in the Hollinwood and Duckmanton wards of the urban district. As supply becomes available in other sections of the town the system will be extended. The work is to cost some £3,500.

Accrington, Lancs.—Considerable progress is being made with the new installation. More than 1,000 lamps in Side-street have been installed. It is expected that the scheme will be completed in the New Year.

Great Yarmouth.—Automatic control of street lighting, to be applied in the first place to 250 lamps, has been sanctioned by the Electricity Committee at a cost of £200. If the trial is successful the Council will be asked to consider the introduction of a complete scheme of street lighting control to cover the whole town.

Merriott, Somerset.—The South Somerset Electricity Company's tender to the Parish Council for twenty-two street lamps has been accepted.

Shenley, Herts.—Six lamps on Black Lion Hill are to be erected for the Parish Council by the North Metropolitan Electric Supply Company.

Hebburn-on-Tyne.—The Urban District Council has decided to enter into a ten years' street lighting agreement with the North Eastern Electric Supply Company, Ltd.

Linwood, Renfrew.—The Council has recommended that £760 should be spent on adapting gas lighting standards in Linwood for electricity, and for the erection of thirty-eight new standards on one of the housing estates.

Manchester.—Electric street lighting is being introduced in Aytoun-street, a city thoroughfare adjoining Piccadilly-gardens, where six 500-watt lamps are being installed, and thirteen 100-watt electric lamps are to be installed on the Mathews-lane Estate, Levenshulme.

Rochester.—Watling-street, Strood, is to be lighted by electricity under a ten years' agreement to be entered into by the City Council. The annual cost will be £423.

Wolverhampton.—Electric street lighting is to be adopted in the Walsall-street area at a cost of £514, and also on the Muchall Manor Estate at a cost of £423.

Chelmsford.—Twenty standards with 250-watt mercury discharge lamps are to be installed in Broomfield-road, from Kings-road to the borough boundary, in order to bring the lighting of this section up to main road standard.

Berwick.—A sum of £6,000 is to be included for electric street lighting in next year's estimates. It will be recollected that Mr. J. F. Colquhoun, Public Lighting Engineer, of Sheffield, was recently called in by Berwick Town Council to report on street lighting problems, and advised the use of electric street lighting.

Gainsborough.—A new street lighting scheme, when completed, will consist of 124 100-watt sodium discharge lamps at a mounting height of 25 ft. Spacing will vary from 108 ft. to 138 ft., depending upon circumstances. Forty-four of the lamps are already in commission, and the remainder of the work is being completed as quickly as possible.

Southend.—The lighting of Leigh Broadway has been recently improved by the installation of sixteen mercury discharge lamps on traction poles at a spacing of 120 ft. A staggered arrangement has been obtained by using alternate poles, the mounting height being 26 ft. with over-hanging brackets. The carriageway width is 34 ft. Other recent electric discharge lamp installations at Southend are at Prince-avenue, an arterial road with 22 ft. dual carriageways, and on Western Esplanade, also with dual carriageways, the mounting height in each case being 26 ft.

Totton, Southampton.—The West Hampshire Electricity Company has recently obtained a contract to erect 226 100-watt lamps in the town. Reflector lanterns will be used, mounted at a height of 15 ft.

Chester.—Compared with ten years ago, two and a half times as much electricity is used annually for street lighting in the city, where the lighting is now all electric, 1,750 lamps being in use. A recent extension using mercury discharge lamps of the colour-corrected type has been completed in Christletin-road. The lamps are at a mounting height of 25 ft. and an average spacing of 135 ft. Twenty-eight 300-watt filament lanterns have also been erected on Parkgate-road widening scheme at a mounting height of 25 ft. and an average spacing of 135 ft. The total cost of this scheme is £901. Both schemes comply with the M.O.T. Final Report recommendations.

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FLOODLIGHTING is good business for user, contractor and supply company alike. Cryselco Lamps, widely used for floodlighting, make satisfaction doubly sure.
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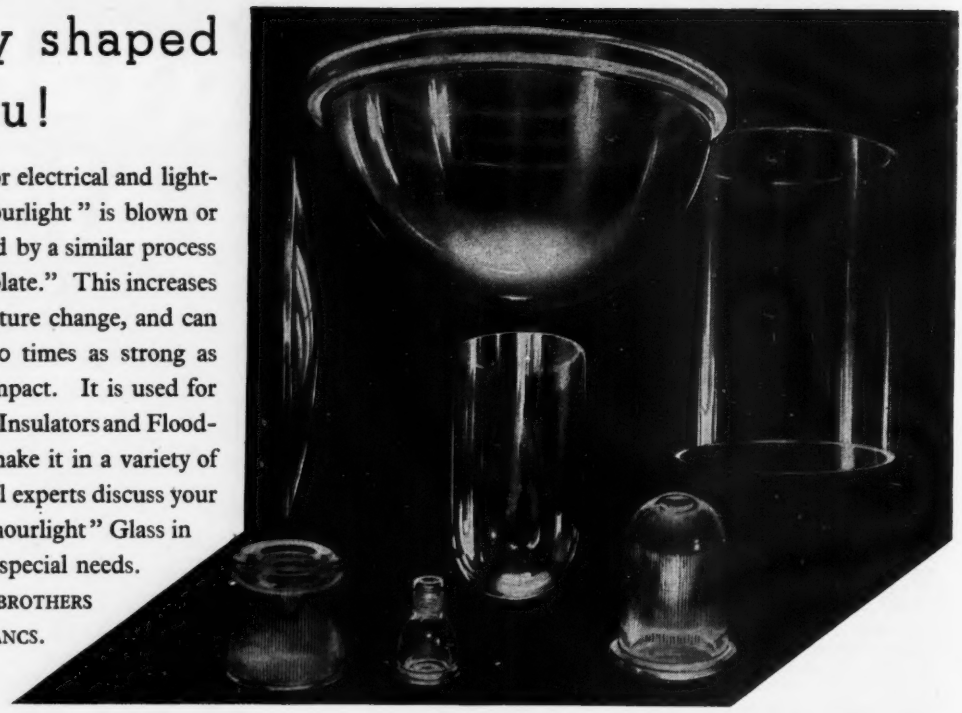

'ARMOURLIGHT' GLASS

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Synthetic Daylight for Shop Windows

We illustrate below an interesting development—the lighting of the show-windows of C. and A. Modes, Ltd. (Oxford-street, London), by a combination of discharge lamps and filament lamps. Realite combination fittings, each containing one 125 w. Philoria mercury lamp with two 150 w. and

two 200 w. Philips tungsten filament lamps, were used, 425 lumens per square foot were allotted, and a special method of soffit mounting installed. The effect of the installation, illustrated here, is considered remarkably good, the combination of the two forms of lamps proving highly effective. The scheme was planned by Rowlands Electrical Accessories, Ltd., in conjunction with C. and A. Modes, Ltd. The architects were Messrs. North, Robin and Wilsdon, and the shopfitters Messrs. Samuel Elliott and Sons (Reading), Ltd. The electrical contractors were the Crabb Electric Co.

Reviews of Books

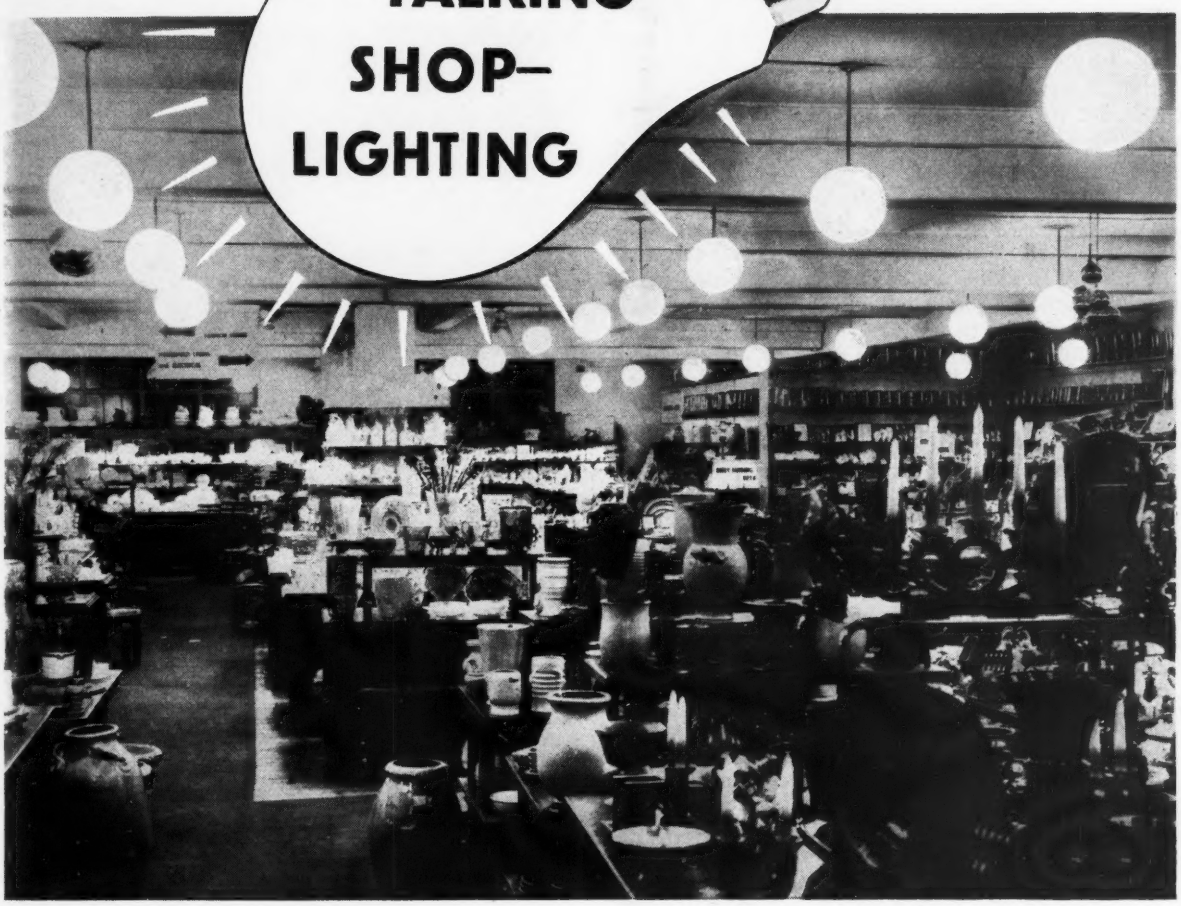
The Practical Electrician's Pocket Book. (Odhams Press Technical Book Dept., London, 1939; 500 pp., 220 illustrations. 2s. 10d. post free.)

The introductory chapter in this edition is contributed by Dr. A. P. M. Fleming and contains a useful survey of recent developments. As usual, there are some new features, notably a new chapter on mechanical ventilation and a section on refrigerators. The chapters dealing with lamps, photometry and illumination, of main interest to our readers, now contain reference to discharge lamps, luminous tube signs, etc., though we do not notice any reference to photo-electric photometers. Other somewhat special items dealt with include kinema equipment and electricity in agriculture. The ground covered is remarkably wide, and the offer of 500 pages of condensed illustration at such a moderate price remains a notable achievement.

Fluorescence and Phosphorescence, E. Hirschlaff, Ph.D. (Methuen and Co., Ltd., 1938; 130 pp., 42 diagrams. 3s. 6d. net.)

There is a tendency in dealing with this subject to devote attention mainly to the many fascinating uses of fluorescence and phosphorescence. In this instance only a brief final chapter is devoted to technical applications. The eleven preceding chapters are all devoted to theory and observed effects and thus afford information, based largely on researches conducted abroad, not readily accessible. Such topics as the fluorescence of atoms and molecules, the quenching of fluorescence, fluorescence and phosphorescence of liquids and solids, absorption and emission processes in phosphors, cathodo-luminescence, etc., are dealt with. The book should be serviceable to students familiar with general effects who wish to delve more deeply into the theory of the subject.

TALKING SHOP— LIGHTING



Lighting for Messrs. John Lewis & Co. Ltd., designed by their own electrical experts, in conjunction with the Crompton Illumination Service.

Photograph by kind permission of Messrs. John Lewis & Co. Ltd.

Shops—and workshops, factories and offices all need good lighting. All need the skilled advice of the lighting engineer. Surveys have to be made, lay-outs prepared and as you know it all takes time. This is where Crompton's may be able to help you when enquiries are taxing your resources to capacity.

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NOTES ON ILLUMINATING ENGINEERING ABROAD

(Specially Contributed—H. L. J.)

Germany.

Recent systematic investigations on a very large scale have been made on Miners' Nystagmus and reported by a medical professional, Dr. E. Zeiss. The original investigations started in 1929 and are being carried out in conjunction with engineers under all possible conditions. Mines with good and bad lighting arrangements, at extreme and low depths, specific danger zones, etc., have all been investigated. The author, as reported in "Licht und Lampe," concludes that the existence of nystagmus is largely due to lack of sufficient illumination. But he also takes the view that the condition of the atmosphere is a second determining factor. The presence of methane and carbonic acid furthers the disease. It has been definitely established that in a mine having the same degree of illumination as another but with a noxious gaseous atmosphere as compared with a pure one more instances of the disease are met. The same applies to people working in the same mine, but in different parts, when different atmospheric conditions prevail.

United States.

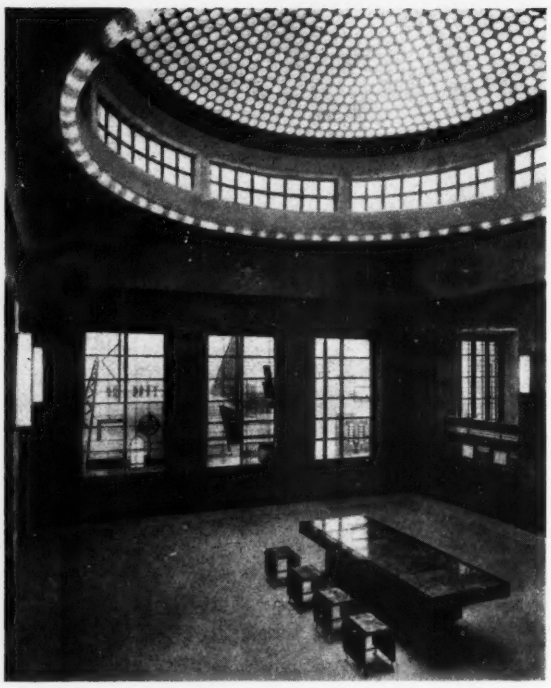
The "New Zealand Electrical Journal" gives further news of the introduction of the recently developed and introduced "Sterilamp," developed by Dr. Rentschler and Dr. James, of the Westinghouse Research Laboratories. Numerous instances of beneficial application of such lamps are recorded. A New York bank has installed them on the grilled windows between teller and bank official, with a view to diminishing spread of disease. Duke Hospital and Perth Amboy Hospital have introduced the lamps in their operating theatres, with the result that operating room infections, met with previously in several out of each 100 major operations, are now almost unknown. Other experiments, conducted by Dr. D. Hart, of the Duke Hospital, Durham, N.C., have proved their germicidal effect, sixty seconds exposure to the radiation at a distance of 5 ft. being in some cases sufficient. Wounds in animals were exposed to the radiation for periods varying from thirty to ninety minutes without apparent damage, but healing seemed to be more rapid.

Sterilamps are also being installed in soda fountains and inside baffles of bars, giving 99 per cent. sterilisation in a few seconds to drinking glasses, etc. It is stated that in the baking industry 15 per cent. of cakes were lost by mould growth before the sterilamps were installed. After installation this loss fell to 2 per cent.

In the field of refrigeration a direct economic advantage is associated with the application of these lamps, for instance, in connection with meat storage. Ice boxes, electrically cooled, have a temperature of 32 to 38 deg. F., with a relative humidity of 60 to 70 per cent. These low temperatures, necessary in order to avoid the creation of mould and slime, have certain drawbacks which the application of the sterilamp, permitting the use of higher temperatures, avoids.

In the United States, where distances are great compared with those in this country, the problem of lighting rural highways is a serious one. In the State of New Jersey, U.S.A., the longest lighted highway in the world will be completed shortly. This is the Horse Pike, a heavy traffic artery, from Atlantic City to Camden, about fifty-six miles. The major portion will be lit by tungsten lamps, but sodium lamps will also be used.

Italy.



The picture above, showing the Post Office at Vincenza, Italy, which appeared in "Il Vetro," suggests a decidedly brighter effect than is usual in this country. Abundant provision is made for access of daylight, both through side windows and through the dome, composed of glass brickets studded in cement. Artificial light is provided by bare filament lamps mounted behind rippled glass encircling the base of the dome.

Switzerland.

An exhibition described as "La Ville Nouvelle" (The New Town) was recently organised in Geneva by the International Organisation for Public Health. The exhibition dealt mainly with modern housing and town planning problems, but included a temporary lighting information bureau, at which posters and specimens of domestic lighting fittings were shown. According to the "Bulletin de l'Association Suisse des Electriciens," the Swiss institute of Electrical Engineers (Lighting Section), who took an active part in the exhibition, erected this stand. The posters emphasised the benefit to health of good lighting and dealt with medical aspects of the subject. The familiar study lamp was on view and likewise the testing apparatus giving visitors an opportunity to select the values of illumination they preferred for reading purposes. There were 15,000 visitors during the two and a half months for which the exhibition was open.

Obituary

Dr. Eugen Brodhun

We record with regret the death of Dr. E. Brodhun, formerly Director of the Physikalisch-Technische Reichsanstalt, at the age of seventy-seven. Dr. Brodhun was best known in this country as one of the inventors of the Lummer-Brodhun photometer, but he also did a considerable amount of other important work in connection with photometry, physiological optics, colour and the origin of colour blindness.

14,000 More ELECTRIC Street Lamps *in 50 areas*

The annual reports of the Association of Public Lighting Engineers for the past two years show clearly that lighting authorities have found that efficient street lighting is Electric Street Lighting. In 50 areas there is a net increase of nearly 14,000 lamps, and these areas are typical of the country as a whole.

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All those responsible for public lighting are invited to apply for a copy of "ELECTRIC STREET LIGHTING" to the British Electrical Development Association, Inc., 2 Savoy Hill, London, W.C.2

Novel Public Lighting in Dublin

By the courtesy of Mr. F. X. Algar, public lighting engineer to the Electricity Supply Board, we illustrate below another remarkable public lighting installation in Dublin. The chief feature is the illumination of exceptionally wide thoroughfares entirely by side units so that the road surface is completely unobstructed.

Just about a year ago* we drew attention to the enterprising experimental installation of "cut-off" units in Merrion-road, Dublin. This new departure met with general approval, and similar methods have been applied elsewhere with equal success. We give below a view of the installation on the Dublin-Dalkey traffic route, seven and a half miles long, which illustrates the advantage of screening the units and obtaining a clear view, free from glare, along the highway.

Mr. F. X. Algar, who was responsible for initiating these experiments, has since been tackling another special problem in street lighting—the treatment of various wide main thoroughfares in central Dublin. The new system now extends from the Parnell Monument to College Green, Dublin Castle, and the junction of Grafton-street and Nassau-street.

The view below shows the appearance of O'Connell-street, which was fitted with 1,500-watt units 30 ft. high, and which varies in width from 100 to 120 ft., with a pavement averaging 18 ft. in width. On other thoroughfares (Westmorland-street, Dame-street, and Grafton-street), which have a lesser width, 1,000-watt units 25 ft. high are used.

The installation is a novel and unusual one, but the result has fully justified the ideas of Mr. Algar, who planned to avoid lamp standards anywhere in the roadway, and even preferred to avoid overhanging units, so as to leave the entire width of O'Connell-street unobstructed. According to conventional ideas, it might have been thought necessary to have at least two rows of lights down the roadway in order to provide satisfactory illumination for a thoroughfare of this great width. Such a scheme, however, would have quite spoiled the appearance of this fine street, which would have been revealed as a forest of poles and a bewildering array of lights.

* "Light and Lighting." December, 1937. p. 355.

A view of O'Connell-street, Dublin, lighted by 1,500-watt units, mounted opposite each other, 30 ft. high, with an average spacing of 116 ft. A feature is the success of the installation in illuminating this broad thoroughfare, the width of which in some places is as much as 120 ft.

The Dublin-Dalkey Traffic Route, illuminated by 300-watt refractor cut-off units mounted on tramway poles 25 ft. 6 in. high, with an average spacing of 121 ft. This is considered a remarkably successful installation of the "cut-off" type combining absence of glare with excellent visibility.

The solution of the ideas put forward by Mr. Algar and accepted by the Dublin Corporation clearly demanded lighting units of special design, which are housed in large bronze lanterns, mounted on polished concrete poles—the latter obtained from France.

These special units, furnished by Holophane, Ltd., embody a two-piece dome refractor and a lower refractor dish. Owing to the great heat developed by 1,000 and 1,500-watt lamps, the inner member of the dome refractor is made in heat-resisting glass. The prismatic construction of the dome refractor and dish is such as to give the main beams at relatively low angles (from the street lighting point of view), namely, at about 70° to 72° from the vertical. In view of the width of the road, the horizontal distribution is very unusual, the main beams being very wide and centred about lines approximately 30° from the direction of the road. The domes are thus designed to light up a rectangular patch, the lantern occupying the centre of one of the sides of the rectangle. In the installation, two lanterns are mounted on graceful arms, springing from the top of each column, the mounting height being 30 ft. from the road surface. The columns are situated at an average spacing of about 116 ft., and are installed opposite one another, instead of the more usual staggered arrangement. The two lamps on each column are mounted immediately over the kerb, so as to throw their main beams obliquely across the road. It may seem surprising that it was thus possible to light effectively so wide a road, but in fact the result is said to be excellent. We understand that the illumination down the middle of the road, where it is 120 ft. wide, is very uniform and is well over 1 ft.-candle, while the diversity ratio, that is maximum to minimum illumination, is of the order of 3 or 4 : 1. The brightness of the road surface is strikingly uniform, and, coupled with the absence of glare, the resulting visibility is exceedingly good.

The lanterns were designed to give a certain proportion of upward light and thus illuminate the buildings lining the street. This condition has also been satisfactorily met, as was illustrated by photographs taken by the light of the installation of the Bank of Ireland and other public buildings. The same form of re-directing equipment was used for the somewhat narrower streets lighted with 1,000-watt units, mentioned previously, where similar results were obtained.

The installation is certainly one of outstanding interest. Great credit is due to Mr. Algar for the enterprise he has shown in planning the new lighting of Dublin and to Holophane, Ltd., for the design of lighting equipment to comply with his aims.

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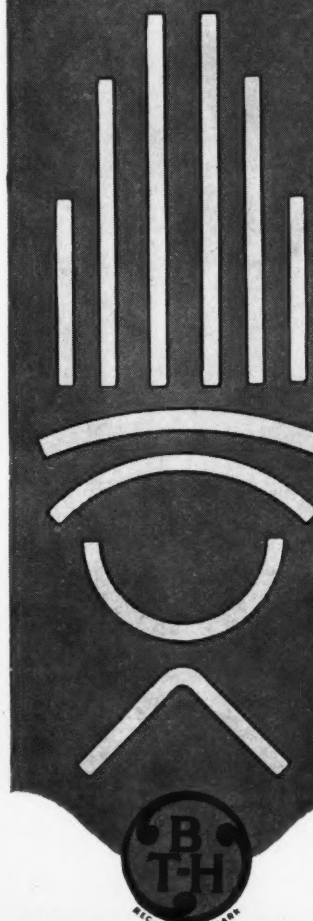

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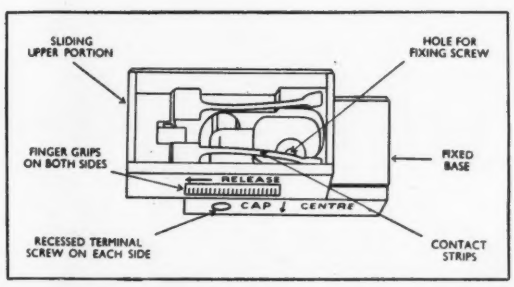
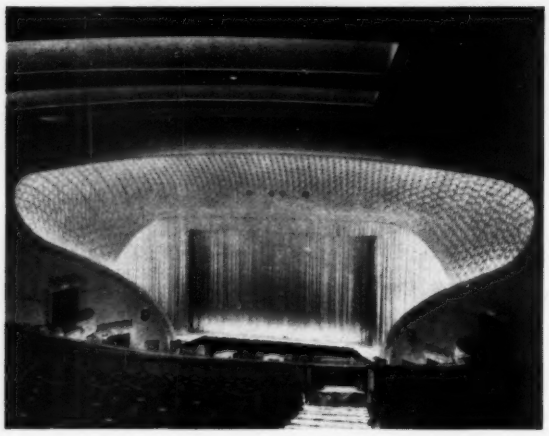


THE BRITISH THOMSON-HOUSTON CO., LTD., CROWN HOUSE, ALDWYCH, LONDON, W.C.2.

The Apollo Cine-Theatre, Manchester: A Novel Design

This latest addition to the number of super cinemas in Manchester is unique in design, being built round the corner site occupied by another cinema, with entrances on each side of the existing hall. The building has a frontage of cream faience designed to



View of hall from back of balcony showing the large area of moulded contour.

give a modern streamlined effect. The interior scheme is in black and chromium.

The combination of interior design and colour lighting scheme is most unusual.

As he enters the auditorium on the balcony level the observer gets the impression that he is literally enveloped in colour—a result of gigantic area of moulded contour designed by Messrs. Mollo and Egan, Ltd., on which coloured light, in constantly changing blends, is continually playing. The moulded contour scheme includes a special stage

Lighting of the vestibule by Holophane built-in "Steplite" units.

design, patented by Holophane, Ltd., which forms part of the huge area of decorative plaster work.

The cut back stage sweeps up in a bold curve at each side and across the ceiling over the gallery, thus linking up half the auditorium under an extended proscenium arch. The effect of the large area of dissolving colours seems to bring the stage lighting over the top of the balcony, and at times it is difficult to forget that this is not a complete atmospheric theatre.

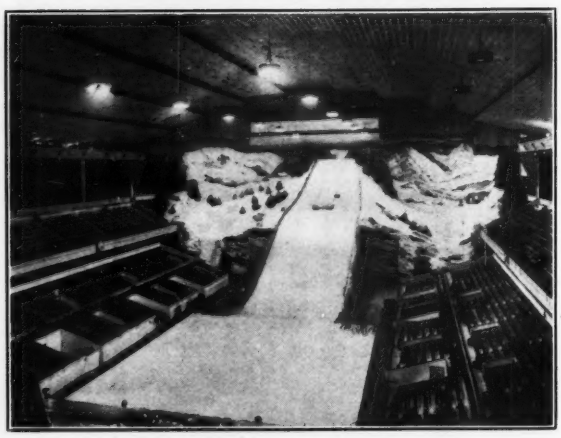
Behind the sloping walls the switchboard equipment is installed, and the producer or stage operator can view the stage show from the front of the house whilst being concealed from the audience.

Sections of troughing are adjusted to cover different areas of the moulded contour section so as to give a uniform lighting effect. The stage lighting consists of a footlight and three battens on four-colour circuits with two nine-unit wing flood trolley units for side lighting. Spot arcs are available in various positions. The selector control panel switchboard is built at the back of the dividing wall, and the auto-selector system is of great value in enabling a single operator to control this elaborate lighting system.

Auditorium lighting over the balcony is by means of three transverse coves in which is concealed Holophane colour lighting equipment, with cornice lighting at the rear of the balcony. The vestibule and entrance hall are lighted by Holophane "built-in" units.

The architects for the building were Mr. Peter Cummings, F.R.I.B.A., and Mr. Alex. M. Irvine, A.R.I.B.A., and the electrical contractors were Messrs. W. J. Furse and Co., Manchester.

Winter Cavalcade



We give above a picture of "Winter Cavalcade"—the Alpine snow scene at Earls Court which has proved such an attractive spectacle. Its effectiveness naturally owes much to artificial light. B.T-H. lighting is employed throughout. Mazda lamps are used to illuminate the area and the vast ski-ing slope, and the fluorescent effects in the ballet are produced by Mercra ultra-violet lamps in special projectors.

Catalogues and Advertising Literature

RESTLIGHT. LTD.—A catalogue featuring "Restlight" (partially corrected) units giving light resembling daylight. Numerous photographs of lighting installations are reproduced, one of the most effective being that of the Ipswich Art Gallery. Particulars of the Lamplough Colour-Matching Lamp, including graphs comparing its spectrum with that of daylight, sunlight, and light from a blue sky, are also given.

TUNGSRAM ELECTRIC LAMP WORKS (GT. BRITAIN), LTD.—Leaflet describing the "Barrier-Layer" photo-elements and their application to photometry, etc. By the use of filters a response closely resembling that of the human eye can be secured. Also literature relating to valves, radio equipment, etc.

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The Illuminating Engineering Society (U.S.A.)

Notes on Transactions (December, 1938)

NEWS.—The I.E.S. (New York Section) has started a *circulating library* of books on lighting and relative subjects. Books may be borrowed up to two weeks. A donation of seventy-five books has been made to the library, referring to problems relating to illuminating engineering. Dr. Luckiesh has published a new book called "Color and Colors." Further news of the Golden Gate International Exposition reports that *approximately 9,000 modern floodlights* will be used for the Treasure Island illumination. Westinghouse has erected an all-electric poultry farm near Philadelphia. Lighting of the actual poultry houses is extended to twelve hours per day throughout the year, with the result that the *egg production during the cold months was increased by 10 to 30 per cent.* About twenty States in the U.S.A. now require *a check on driving vision before the driving licence is issued. The eighth annual meeting of the Inter-Society Colour Council* will be held in New York City on February 23.

SUBJECTS OF PAPERS.—*General Secretary's Report*, 1937/38. Mr. A. E. Cameron gave the usual account of the Society's activities during the past year. Regarding membership, there were 315 losses, due to various causes, against an increase of 630—a total gain of 315. The Society comprises nineteen sections and records a total membership of 2,684 on September 13, 1938. The American Code for School Lighting, published in 1937, has since been reprinted in two editions of 10,000 copies each, and a third reprint is being prepared. The financial status of the Society shows a balance in hand of 5,483 dollars 75 cents. Sustaining membership totalled 184 and represented 17,765 dollars 14 cents. Interesting examples of the work of committees are given. The Committee on Public Information, the Society's Press Bureau, has established continuous relations with the Press, and through these channels the Society's activities have been brought to the public. The Committee on Street and Highway Lighting has been concerned with the revision of the I.E.S. Code on Street Lighting, which it is expected will be completed at an early date. A subcommittee thereto is concentrating on road surface conditions. Finally, it is mentioned that nine of the Society's representatives are delegated to the United States National Committee of the International Commission on Illumination.

This Year's Progress in Lighting.—The usual report of the year's working has been compiled by the Committee on Progress. The British Street Lighting Report and investigations into factory lighting, in connection with the new Factory Act, are mentioned, also the German activities in the "Better Light, Better Sight" campaign. Reference is made to such sources of light as the standardised fluorescent Lumiline lamp and the tubular-shaped 500-watt medium bi-post-base lamp. In aerodrome lighting the 10-Kw. G.-96 bulb lamp has been redesigned, and is now made with the Mogul bi-post-base instead of the prong base formerly used. The 1,200-watt T.-12 filament lamp for projection purposes is mentioned, particularly for home movies. New mercury vapour types have also been introduced, such as the special 250-watt quartz inner bulb lamp, a 100-watt quartz inner bulb lamp, and a 1,000-watt capillary type, water cooled. In the field of low-pressure electric discharge lamps a new 33-in. 275-watt tube, specially intended for combination with incandescent lamps, has been introduced. The design of home-lighting fittings has been stimulated by the prize competition organised by the I.E.S. in conjunction with the American Institute of Decorators. In the development of industrial lighting fittings the canopy type for assembly with the range of new fluorescent lamps, to give daylight colour, is noticeable, also the development of outdoor floodlighting for safety. In school lighting development a marked trend is shown towards indirect lighting and photo-cell control. Highway lighting is also developing very favourably, and New Jersey has taken the lead with 220 miles of State highways lit. Favourable experience of the National Electrical Code, in force since November 1, 1937, is recorded. The National Adequate Wiring Programme campaign, for safety and adequate residential wiring, launched last year, has also had good results.

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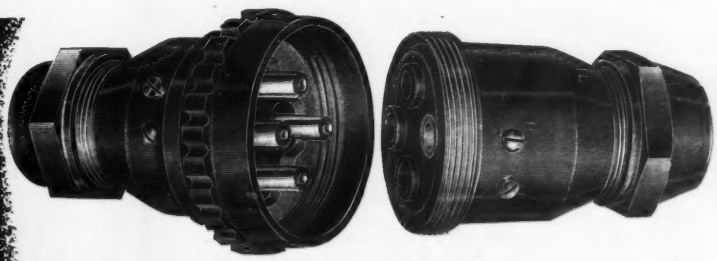

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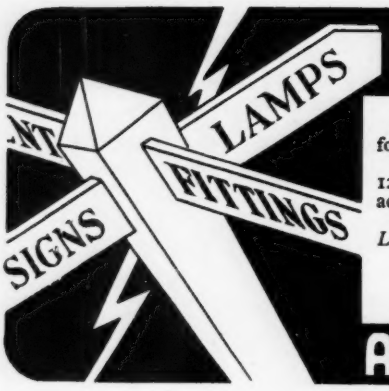

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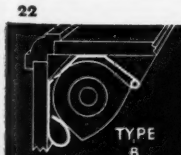
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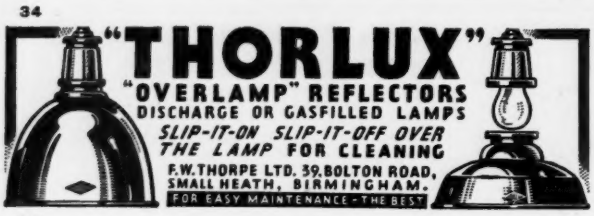
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SPECIALISTS IN THE TREATMENT OF CELLULOSE ACETATE FOR SHADES, FITTINGS, FIXTURES, ETC

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WARDLE ENGINEERING Co., Ltd.

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STREET LIGHTING EQUIPMENT. FLOODLIGHT PROJECTORS
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FOR SALE.

500 14-in. Square Copper Gas Lanterns in good condition. Offers invited for the whole or portion of this number. Samples can be seen at the Public Lighting Department, Cambridge-street, Birmingham. Offers should be forwarded to City Engineer and Surveyor, Public Works Dept., Birmingham, not later than January 31, 1939.

Index to "Where to Buy"

Accessories	29	Lampshades	35
Artificial Daylight	27	Local Lighting	10, 23
Architectural Lighting	1, 9, 17, 18, 22, 32, 36	Photo Electric Cells	26
Automatic Light Control	16, 20, 26	Photometers	2, 13
Cinema Lighting	18, 19, 25, 28, 32	Reflectors	3, 4, 9, 11, 12, 19, 31, 34, 37
Concrete Pillars, etc.	7	Signal Lights	37
Electric Lamps	5, 28	Special Lighting	3, 17, 19, 25, 27, 32, 36, 37
Fittings	1, 3, 4, 8, 12, 13, 15, 17, 18, 19, 22, 24, 25, 27, 28, 32, 33, 34, 35, 36, 37	Steel Standards	6
Floodlighting	3, 5, 15, 19, 28, 32, 37	Street Lighting Units	5, 11, 12, 13, 19, 21, 24, 28, 33, 37
Gaslighting	21, 24, 33	Theatre Lighting	3, 19, 32
Glassware	19	Time Switches	16, 20
Industrial Lighting	4, 12, 13, 19, 27, 28, 37	Winches and Suspension Gear	30

N.B.—The numbers are those attached to individual entries in the Directory (See pp. 20-22)

Lighting Fittings at the 1939 Leipzig Spring Fair

(Communicated.)

About a year ago highly ornate designs appeared to be the predominating fashion for electric light fittings. Chandeliers and reading-lamps frequently showed marked baroque influence. Many highly decorative lamps were sold to British buyers at the Leipzig Fair.

But in the early months of the current year it became apparent that the demand for this type of design with its wealth of detail was slackening. A comparison of proposed exhibits at the 1939 Leipzig Spring Fair with last year's display clearly reveals a reaction against ornate designs. The approaching Spring Fair will show that fashion has decreed simple light fittings for 1939, midway between the plain austerity of those in favour four or five years ago and the exaggerated baroque of more recent styles. The new models, to be shown in Leipzig next spring for the first time, in short, aim at avoidance of dullness and fussiness, and almost all of them could be used in conjunction with many different styles of furniture without disturbing the harmony of the whole or seeming out of place.

Bronze and brass are being used to an increasing extent for making ceiling-light fittings. In general the bronze fittings are more elaborate in style than the brass ones, which are carried out entirely on simple lines. Various factories are sending bronze articles tinted to new shades.

Diffusing glass bowls, yielding a soft light, still remain in favour. The prevailing fashion in 1939 will probably be for smoke-coloured and fairly transparent kinds of glass. These sold well for use with hall and landing lights, and have therefore been utilised recently for dining and drawing room lights as well. Amber-coloured glass is found only amongst the cheap and comparatively inexpensive goods in the 1939 spring collections.

Cardboard lamp-shades, however, also maintain their popularity. A large range of silk shades will, of course, be shown, but these are less affected by the vagaries of fashion. In some of the newest lamp-shades cardboard and cloth are combined, the outside being constructed of very strong, washable cardboard, which is lined with linen, artificial silk, or synthetic wool, and produces a somewhat unusual effect when the lamp is alight. A new development is the manufacture of lamp-shades in synthetic wool, a material which rather surprisingly has proved to be eminently suitable for this purpose.

New models of fittings in wood and wrought iron will also be on view.

New Branches and Depots

Crompton Parkinson and Co., Ltd., have recently found it necessary to establish additional branches at 30, Commercial-road, Portsmouth and Dunstable-road, Luton. Other existing branches now include Belfast, Birmingham, Bristol, Cardiff, Glasgow, Leeds, Liverpool, Manchester, Newcastle, Nottingham, and South Shields.

The General Electric Co., Ltd., has opened new stores depots at 12, Foyle-street, Londonderry, and at 109, Thornton-road, Bradford. Mr. W. A. McGlay has been appointed in charge in Londonderry and the Bradford depot is under the charge of Mr. W. H. Cliff.

G.E.C. Contracts

The North Eastern Electric Supply Company has placed an order for the supply of 119 side-mounting di-fractor lanterns complete with Osira lamps for a new street lighting scheme at Hebburn-on-Tyne. 550 directional reflectors of various types have also been ordered for the lighting of secondary streets.

Other orders and contracts include: *South Shields Corporation* and *Sunderland Corporation* (12 months' supply of Osram lamps), *Hale U.D.C. Manchester* (45 concrete columns, lanterns, and 500-w. street lighting equipment), *Edinburgh Corporation* (500 Wembley lanterns), *Anglo-American Oil Co., Ltd.* (flame-proof floodlights for oil jetties).